



Lunabotics Mining Competition

FAQ (new or revised Q&As in red)

Sandbox Questions

Q. At the 2009 Regolith Excavation Challenge, some of the competitors kicked up a LOT of simulant (enough that visibility more than a meter was almost impossible). Given that two teams are competing at the same time, will there be any measures in place to make sure teams won't be at a disadvantage?

A. Regarding the dust mitigation, the Lunabotics Mining Competition sandbox is much larger than the 2009 Centennial Challenge sandbox and the two robots will be on separate sides of the box. However, the possibility of dust is a challenge which you need to design around and overcome.

Q. Can we use LED lights on the lunabot for situational awareness to mitigate the dust?

A. It is up to the teams to decide if they want to have their own cameras mounted on the robot or use the situational awareness cameras provided. LED lights were used at the 2009 Regolith Excavation Centennial Challenge for situational awareness. We will have a camera at each end of the sandbox: one looking towards the mining area and one looking towards the collector box.

Q. Can we set up our own cameras in the room (not on the robot) in order to monitor the robot?

A. No, only NASA house cameras may be used for off board camera situational awareness.

Q. How many camera views are in the sandbox? Will the monitor view given be in color or black and white?

A. The monitors in the control room will be color. The actual placement and angle of the cameras in the corners of the tent looking down on the sandbox will not be known until we set it up the week before the competition.

Q. How full will the sandbox be? If the depth of the box is 1 meter, is it safe to assume the regolith will be about a meter deep?

A. The BP-1 aggregate will be less than one meter in depth. The sandbox itself is 1 meter high and we will have enough of a border to safely contain the excavators. The collector bin will be approximately 1 meter in height from the surface of the BP-1 aggregate.

Q. Will the regolith get thicker/more compressed with depth?

A. The density of the compacted BP-1 aggregate will be between 1.5 g/cm³ and 1.8 g/cm³. The top 2 cm will be raked to a fluffy condition of approximately .75 g/cm³. There are naturally occurring rocks in the BP-1 aggregate.

Excavation Questions

Q. Concerning rule #29. The rule says no far reaching mechanism. What distance is considered far reaching?

A. Please refer to Rule # 24. The hardware may deploy beyond the 1.5 m x .75 m footprint after the start of the competition attempt, but may not exceed a 2 meter height. The excavation hardware may not pass beyond the confines of the outside wall of the Lunarena and the collector during the competition attempt to avoid potential interference with the surrounding tent.

Q. Is a 2 robot system (one to dig and one to dump) allowed for the competition? If we can use a 2 robot system is there any regulations concerning that?

A. A two robot system is allowed but the total mass and starting dimensions must still meet the rules.

Q. Can hydraulics or pneumatics be used on the excavator?

A. No, hydraulics and pneumatics cannot be used. They are not a good solution for the moon. The problem with hydraulics is not the G force. It is the thermal environment. Most hydraulic fluids will freeze in the shade and boil in the sunlight unless very well protected. Hydraulics also have a tendency to leak and require a lot of maintenance. Therefore, we do not anticipate the use of hydraulics on the moon.

Q. Concerning the emergency stop push button, is it acceptable to modify a 4 cm push button, to have a 5 cm button diameter?

A. The red push button must be utilized as stated in the rules. It must be highly reliable and instantaneous. For these reasons an unmodified "Commercial Off -The- Shelf" (COTS) red button is required.

Q. Will we be able to recharge the batteries? What kind of access will there be to the excavator?

A. Yes, you will be able to recharge your batteries during the practice days and the competition days. Each team's competition attempt will be determined by random drawing. The lunabots will be quarantined during the competition. However, you will be able to re-install your battery before you compete with the inspection judge observing. You will have 10 minutes to put your robot in the sandbox before the 15 minute timed competition attempt begins.

Q. Are SLA batteries (sealed-lead acid batteries) approved for use in the robot?

A. Yes an SLA battery is acceptable.

Q. What is the game play "Traversal Direction" in rule #6?

A. The "traversal direction" in Rule #6 refers to the direction the excavator will be facing at the beginning of the competition attempt. The front or forward face will be based

on the reference point on the excavator. Please note in the definitions: "Reference point" will indicate the forward direction of the excavator.

Reference point – A fixed location on the excavation hardware which will serve to verify the starting location and traversal of the excavation hardware within the sandbox. An arrow on the reference point must mark the forward direction of the excavator in the starting position configuration. The judges will use this reference point and arrow to orient the excavator in the randomly selected direction and position.

Q. Are we allowed to use air-filled tires? Are we allowed to use foam-filled tires?

A. No, you are not allowed to use air-filled tires. Since foam filled tires are not likely to work in a vacuum, you should not use foam-filled tires unless you can make the case for foam working in a vacuum.

Q. What will be the lighting conditions?

A. Lighting will be by artificial lamps inside a tent structure. Assume daylight conditions.

Q. What will be the atmosphere in the competition zone?

A. The atmosphere will be an air conditioned tent without significant air currents, at approximately 77 F.

Non-Excavation Questions

Q. Concerning rule #32. It says we must submit a video showing the operation of the hardware. We have searched and can not find when that is to be submitted by. Is there a deadline date for the video or is it used during the competition?

A. We will let you know at a later date when and where this video will need to be submitted. It will not be needed any earlier than April.

Q. We would like to know if there is an average cost that last year's teams spent on their lunabot.

A. Estimates vary between \$10,000 - \$20,000 for materials, testing, roundtrip shipping and travel.

Q. Concerning the slide presentation, do you have any more specifications as to the expected contents of the presentation than are listed on the website?

A. We have not given any additional guidance other than the rubric on-line.

Q. How long should the slide presentation be? Are there any time restrictions?

A. There is no established maximum or minimum time on the slide presentation. It only needs to address the elements in the rubric. Teams will be allowed to briefly present their presentation at the competition for Team Spirit points.

Q. Are the Systems Engineering Paper and the document in Rule 31 the same thing?

- A. No, they are not the same thing. The Systems Engineering Paper is an extensive paper due on April 18, while the document in Rule 31 is brief documentation containing a description of the excavation hardware, its operation, potential safety hazards, a diagram, and basic parts list with a due date to be determined.

To clarify, although the Systems Engineering Paper may contain what is required in Rule 31 below, it should mainly address the systems engineering approach that your team took to design and build your robot. The 2011 Lunabotics Mining Competition Rules and Rubrics can be viewed here: [Lunabotics Mining Competition Rules \(PDF\)](#)

Q. Concerning the Lunabotics Systems Engineering Paper, is the 10-15 page limit a requirement or a limitation. If we go over the limitation are we going to be penalized or disqualified?

- A. The 10-15 page limit is a limitation. You may add things in the Appendix but the actual paper must be no more than 15 pages.

Q. With respect to the “Risk Assessment” portion of the Systems Engineering paper, are you looking for risks associated with power failure/shorts, mechanical design failures, communication failure, other topics, or all of the above?

- A. The risk assessment portion of the paper should address sub-system risks and integrated system risks. The purpose of the risk assessment is to understand the likelihood and the related consequence of a potential failure. The combined values provide a quantification of risk levels. The risk items are then addressed in order of priority with a risk mitigation strategy. In this way all the risks can be addressed and eliminated to lead to the highest chance of mission success.

Q. We are modifying an old robot of ours for this competition, and we utilized it as an exhibit for young people at a NASA function. We have many photographs of the children interacting with our exhibit. Would this count as community outreach?

- A. No, community outreach involves an educational activity your team plans and hosts in your local community for students or the public. You may be creative and have fun with it but it does need to be done locally as a part of this competition. The rubric explains: All teams must participate in an educational outreach project. Outreach examples include actively participating in school career days, science fairs, technology fairs, extracurricular science or robotic clubs, or setting up exhibits in local science museums or a local library. Other ideas include organizing a program with a Boys and Girls Club, Girl Scouts, Boy Scouts, museum, etc. Teams are encouraged to have fun with the outreach project and share knowledge of science, robotics, and engineering with the local community.

Q. The college I am taking classes with will not be entering the competition. If, my former university approves, would NASA allow me to work with my previous college on this competition?

A. That is not a problem as long as your former university is okay with it.

Q. Should the faculty advisors appear in the Team Picture? And should the faculty advisors be part of the team biography?

A. Yes, we would like the whole team including the faculty advisors in the team picture, if possible, and included in the team biography.

Q. What information should be included in the team biography?

A. The team biography is for the competition program. Each team will have a page in the program. It should be something that each team would like everyone to know about them -- something that makes the team special or different.

Travel & Competition

Q. When will the hotel information be available?

A. Each team may choose where they would like to stay during the competition. The Space Coast Office of Tourism offers a website for lodging accommodations, dining and entertainment. Please visit <http://www.space-coast.com>. In order to make hotel arrangements through another site, look for lodging in Titusville, Merritt Island, Cocoa, or Cocoa Beach, Florida.

Q. Will there be any meals provided during the competition days?

A. There will be food available for purchase during the practice days and the competition days.

Q. Do all official team members need to be present for the competition?

A. No, all team members do not have to be present, just enough to effectively operate your Lunabot.

Q. We have people who are not university students that are interested in being officially a part of the team. Are we allowed to list them as official team members?

A. No, they may not be official members of your team. You may have corporate consultants or advisors as part of a team sponsorship.

Q. Do the forms and transcripts need to be provided for team members that will not be present at the competition?

A. Yes, we need the forms and transcripts for all members on the team, even if they are not coming. The reasons are:

- We award points for each different STEM discipline represented on a team.
- We need to verify all team members are college students.
- We need the media release for all team members for pictures and film that may be provided by the team.

Q. How and what do we need to provide you for the collaboration notification?

A. We will request a team roster from all registered teams at a later date. The students' transcripts will be collected at that time and will be the proof that the team is collaborating. The collection instrument is still under construction. This year we are streamlining this process to ensure more accuracy.

Shipping

Q. May the universities ship their lunabots directly to Kennedy Space Center?

A. You may ship the robots to arrive no earlier than a week before the competition. They will be held in a safe area.

Q. What is the address of the department which will take receipt of the lunabot if we choose to ship it?

A. The shipping address is to be determined.

Q. Do we need to arrange for the lunabot to be shipped back home?

A. Yes, return shipping arrangements must be made prior to the competition.